Code 582
Flight Software Branch

[Mission Name (Mission Acronym)]

FLIGHT SOFTWARE REQUIREMENTS MANAGEMENT USERS GUIDE

Flight Software Branch – Code 582

Template Version 0.1 – 05/06/05

582-2005-006

(Replace with Mission FSW Requirements Management Users Guide Version)

Goddard Space Flight Center
Greenbelt, Maryland

National Aeronautics and
Space Administration

DOCUMENT CONTROL

This document is a [MISSION NAME] Flight Software Team controlled document. Changes to this document require prior approval of the FSW Product Development Lead. Proposed changes shall be submitted to the [MISSION NAME] FSW [DOCUMENT CHANGE AUTHORITY].

Aaa A. Aaaaa/nnn

[MISSION NAME] FSW Product Development Lead

FORWARD

This document is a skeleton Requirements Management Users Guide intended for use by Code 582 (Flight Software Branch) personnel as the basis for a mission-specific Flight Software Requirements Management Users Guide.

The following style conventions are used throughout:

Text in this style (style name "BODY") is used for text and should be included without modification. All document section headings are in the same category (although their style names vary depending on outline level).

[Text in this style (style name "TAILORING ADVICE") is advice on how to tailor the text in any specific section.]

As the plan is developed, the generic [TAILORING ADVICE] text should be replaced with material that applies to the specific project.

GENERAL TAILORING GUIDELINES

This section includes general tailoring guidelines applicable to the whole document. Specific recommendations are included in applicable sections.

The FSW Level for which the requirements are managed varies depending on the mission. Use appropriate level for [LEVEL] in the document.

Some missions may have multiple processors and requirements that may be common for multiple processors. Include any special handling needed for these requirements.

The following disclaimer appears on all pages: "Printed copies of this document are for REFERENCE PURPOSES ONLY! The only controlled copy of this document is located on-line at http://xxxxxxxx". This disclaimer should be modified to contain the appropriate URL, but should not be removed.

Finally, in the target document, this entire section ("Forward") can be deleted or replaced with product-specific information.

SIGNATURES

Submitted by:

_____ _____
Aaa A. Aaaaa/nnn Date

Approved by:

_____ _____
Elaine Shell/582 Date
Flight Software Branch/Head

_____ _____
Aaa A. Aaaaa/nnn Date
[MISSION NAME] Flight Software C&DH Development Lead

_____ _____
Aaa A. Aaaaa/nnn Date
[MISSION NAME] Flight Software ACS Development Lead

_____ _____
Aaa A. Aaaaa/nnn Date
[MISSION NAME] Flight Software Test Lead

UPDATE HISTORY

Version	Date	Description	Affected Pages
0.1	05/30/05	Baseline	All

CONTENTS

1.0 INTRODUCTION

1.1 DOCUMENT PURPOSE

The Flight Software (FSW) for the [MISSION NAME] mission is developed by the Flight Software Branch (FSB) of the Information Systems Division (ISD). This document describes how the [MISSION NAME] FSW requirements are organized and managed in the [MISSION NAME] Requirements Management tool, *RequisitePro*.

1.2 DOCUMENT SCOPE

Basic familiarity with RequisitePro is assumed. Detailed on-line help on RequisitePro is available when the client is installed on the user's computer. User account and access to the [MISSION NAME] project in RequisitePro is assumed. Contact the [MISSION NAME] RequisitePro administrator for a user account and help in installing RequisitePro client.

1.3 DOCUMENT ORGANIZATION

This document is organized as follows.

Section 2 describes how requirements are organized and viewed in RequisitePro.

Section 3 illustrates how bi-directional requirements traceability is set up. Traceability to parent requirements, to design specifications, and to test specifications is described.

Section 4 documents how requirements are managed in RequisitePro.

Section 5 describes how documents and reports are generated from RequisitePro.

Appendix A provides brief installation instructions.

1.4 RELEVANT DOCUMENTS

1.4.1 Parent Documents

None.

1.4.2 Reference Documents

Provide a list of Reference Documents (e.g., CM Plan).

2.0 REQUIREMENTS IN REQUISITEPRO

RequisitePro offers the unique feature of linking requirements within a document to a database containing all project requirements, thus allowing the requirements to be documented naturally, and, at the same time, making them accessible and manageable in a database. The original requirement documents are available at [DOCUMENT LOCATION IN CM OR WEB SITE URL] and serve as the sources for the requirements in RequisitePro.

2.1 REQUIREMENT ORGANIZATION

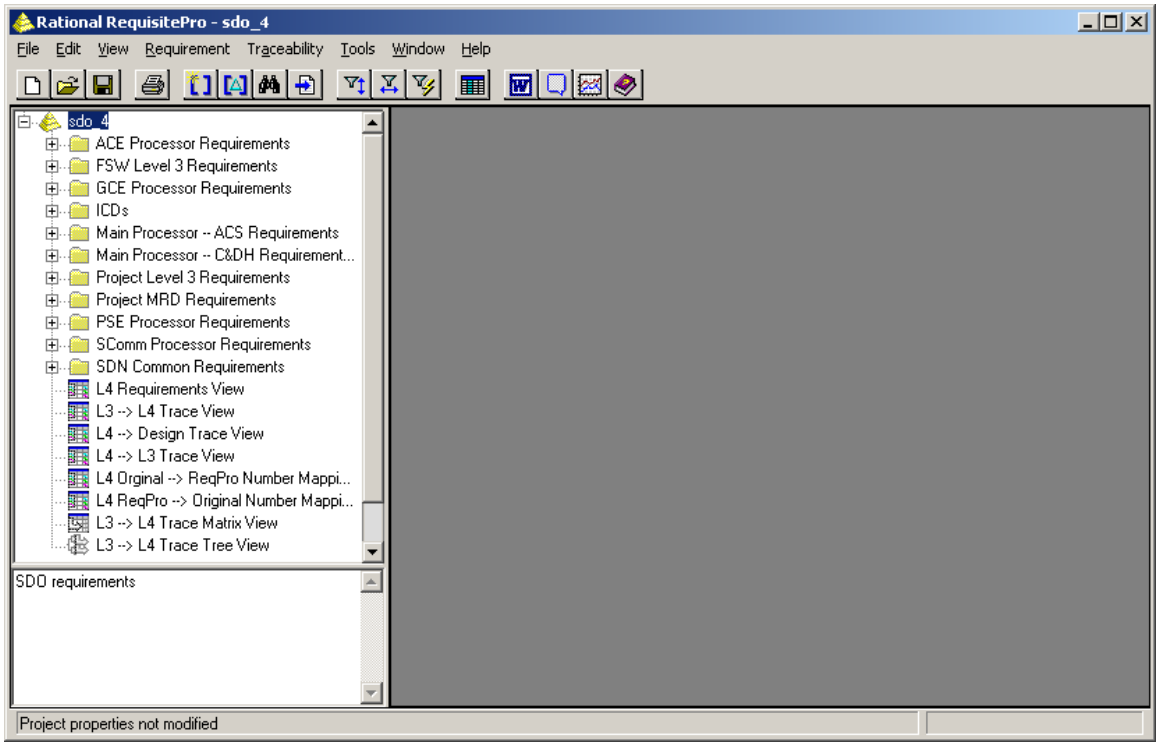
Requirements in RequisitePro are organized into ***projects*** and ***packages***. For [MISSION NAME] the project name is **[REQUISITEPRO PROJECT NAME]**.

Describe how the packages are organized. For example the packages may be organized to hold different processors and/or subsystems. Packages may be defined to hold high level requirements, e.g., MRD, ICDs, "higher level FSW," etc. Include only those high level requirements that directly trace to the detailed FSW requirements. For example the "higher level FSW" requirements could capture all the FSW-related requirements from MRD, ICDs, etc., in which case only the "higher level FSW" requirements would need to be in RequisitePro for traceability.

In addition to the definition of packages, RequisitePro allows the definition of ***Requirements Types*** to facilitate requirements organization across packages. The user assigns a prefix and a starting number for a requirement type, and RequisitePro assigns a sequential number to requirements within that type as they are entered. For [MISSION NAME], the following types (and prefixes) are defined:

Define the Requirements Types and their prefixes. See Examples below.

- FSW Level 4 Requirement (**F**)
- FSW Level 3 Requirement (**FSW**)
- MRD Requirement1 (MRD)



Replace above figure with project specific figure.

Figure 2-1. [MISSION NAME] Project and Packages in RequisitePro

2.2 IMPORTING REQUIREMENTS AND DOCUMENTS INTO REQUISITEPRO

2.2.1 Requirements in Microsoft Word Documents

When the sources of the FSW requirements are Microsoft Word documents, the requirements are imported directly from those documents using the *RequisitePro File Import Wizard*, using ***File > Import > Microsoft Word Document***. Copies of the original Word documents are maintained as ***RequisitePro Word*** documents under the respective packages (RequisitePro Word looks same as Word but has RequisitePro macros built in). **The requirements in the RequisitePro Word document and in the database are tightly coupled.** For example, if a change is made to a requirement in the RequisitePro Word document, the database will reflect a corresponding change, and vice versa. RequisitePro Word documents can be saved as Word documents and may be transmitted or printed anytime; the original contextual information and appearance is preserved, except for requirement formatting as illustrated in Figure 2-2.

Specify which requirements are imported from Word documents. If there are requirements that are common to multiple processors in Word documents describe how they are handled.

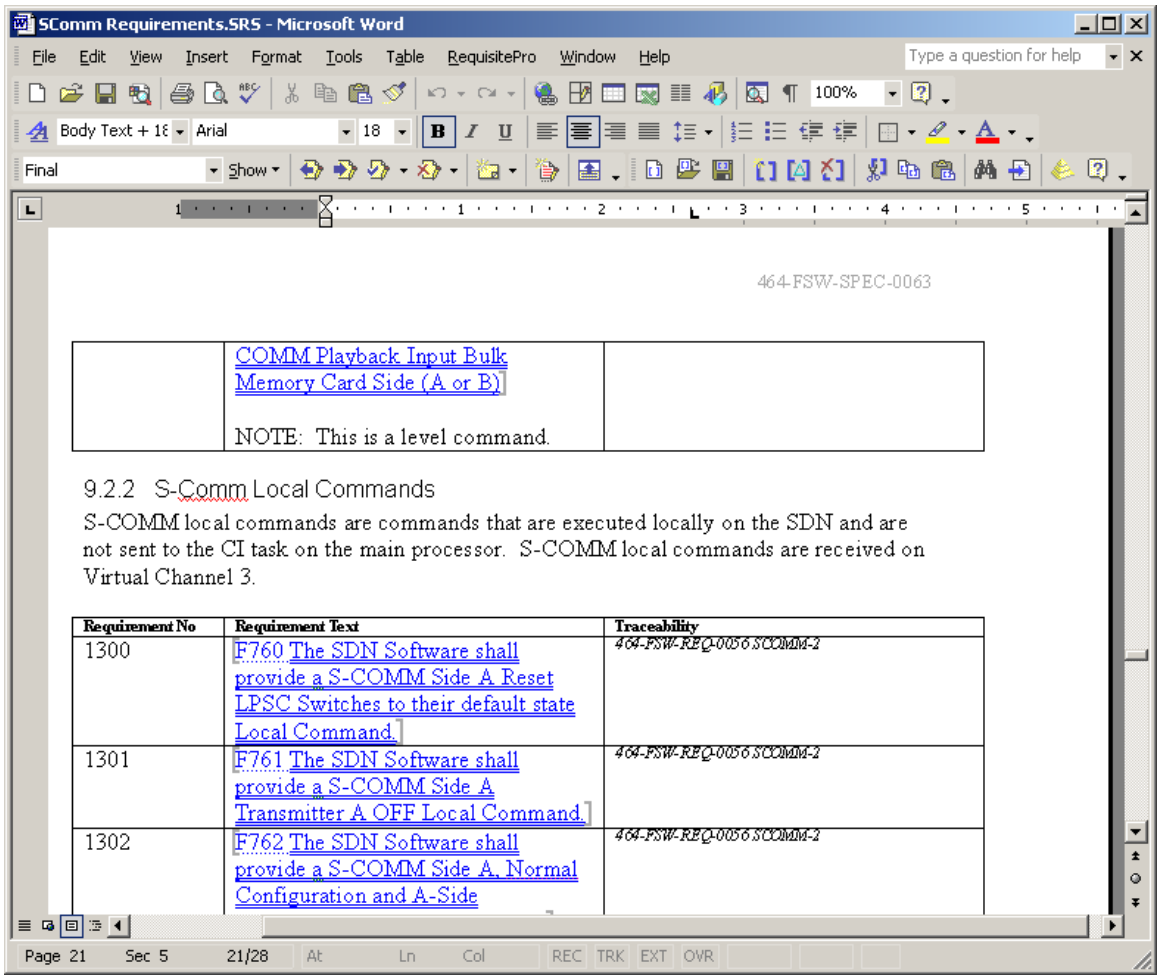
Although the Import Wizard does most of the work, some manual update is needed to:

1) Move the bulleted items into the requirements;

2) Establish parent/children relationship;

3) Include requirements missed by the wizard; and

4) Enter attributes specific to each *Requirement Type*.



Replace above figure with project specific figure.

Figure 2-2. – Requirements document in RequisitePro Word

2.2.1 Requirements in Non-Word Documents

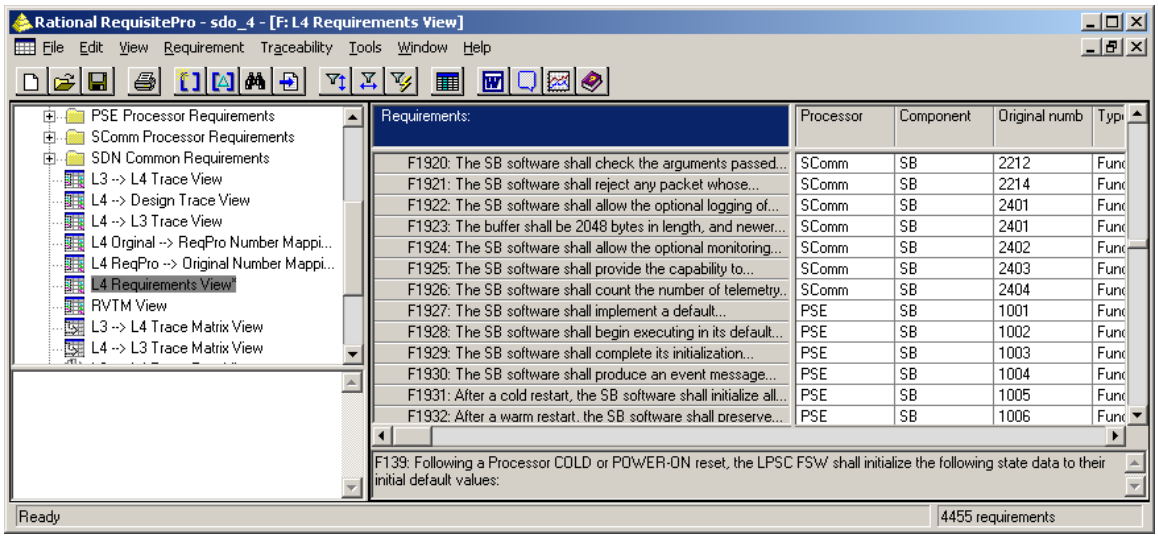
Requirements that are in non-Word documents, e.g., Excel, are imported using *RequisitePro File Import Wizard*, using ***File > Import > Comma Separated Value (*.CSV) File***, or entered manually. These **non-Word documents are not maintained within RequisitePro**. So, when requirements are changed they have to be changed in the original documents as well as in the RequisitePro database.

Specify which requirements are imported from non-Word documents. If there are requirements that are common to multiple processors in non-Word documents describe how they are handled.

2.3 REQUIREMENTS NUMBERING

If there is more than one processor then include processor in the following paragraph as indicated.

RequisitePro creates its own internal numbers for requirements but does not provide too much flexibility – only a starting number may be specified for each of the requirement types discussed above. Therefore, to provide maximum flexibility, the project-unique requirement numbers are stored as attributes (sec. 2.4). For FSW Level [LEVEL] requirements the combination (***[Processor,] Component, Number)*** is unique for any requirement (e.g., **[PROCESSOR NAME,] HK, 1021**), as shown in Figure 2-3. The mapping between these numbers and RequisitePro's internal numbers may be easily generated, if needed – for example, for traceability.



Replace above figure with project specific figure.

Figure 2-3. Requirements Numbering

2.4 ATTRIBUTES

Several *attributes* are associated with each requirement type. The attributes give information beyond just the statement of the requirement.

The [MISSION NAME] (FSW Level [LEVEL]) requirement type has the attributes shown in Table 2-1. Some of these are lists with only certain allowed values, as shown. The others are text or date fields which can contain any value. **The attributes – *[Processor,] Component,* and *Number* – uniquely identify a requirement and must be set as soon as a new requirement is created.**

Describe attributes for other *requirement types*.

Table 2-1. Requirements Attributes

Modify Table as needed.

Attribute	Type	Value
General		
Processor	List	Main, ACE,.GCE.
Component	Text	ACE, ACS, CI, CS, DS, HS, MD, MS, RT, SB, SC, SM, Time, TO, TS
Number	Text	*(from* [MISSION NAME] *document)*
Subsystem	Text	ACS, CDH
Type	List	*Functional, Performance*
Status	List	*Deleted, Draft, Review, Baseline, Implemented, Build tested, System tested*
Common	List	No, Yes
Reuse source	Text	
Requirement comment	Text	
Design		
PDR Section	Text	
CDR Section	Text	
Build Test		
Planned build	Text	
Actual build	Text	
Build test method	List	*Demonstration, Analysis, Inspection, Unit test only*
Build test procedure	Text	
Build tester name	Text	
Planned build test date	Date	
Actual build test date	Date	
Build test result	List	*Pass, Fail*
Build pass date	Date	
Build test log file	Text	
Build test comments	Text	
Telemetry	Text	
Commands	Text	

Table 2-1 (con't). Requirements Attributes

Attribute	Type	Value
System Test		
System level test	Text	
System level test procedure	Text	
System level test method	List	*Demonstration, Analysis, Inference, Build Test only*
System level tester name	Text	
Planned system test date	Date	
Actual system test date	Date	
System test result	List	*Pass, Fail*
System level pass date	Date	
System level comments	Text	
System test log file	Text	
Test platform	Text	
Miscellaneous		
CCR	Text	
CCR Status	Text	
DR	Text	
DR Status	Text	

2.5 VIEWS

RequisitePro provides three types of views – ***Attribute Matrix***, ***Trace Matrix***, and ***Trace Tree*** views. *Attribute Matrix* views are used to view all or any desired subset of attributes, and create and update attribute values; *Trace Matrix* and *Trace Tree* views are used to view, create, or update traceability information.

Several views are created for [MISSION NAME] to present various types of requirements, attributes, and traceability information; these views are listed in Table 2-2. Additionally, users can create *private* views for their specific needs.

Table 2-2. [MISSION NAME] RequisitePro Views

Modify Table to reflect views created in Requisitepro

View	Package
Requirement Views	
MRD Requirements view	
L3 Requirements View	
L4 Requirements View	
Main ACS Requirements View	
Main C&DH Requirements View	
Processor 1 Requirements view	
Processor 2 Requirements view	
Traceability Views	
L3 → L4 Traced-to View	
L3 → L4 Trace Matrix View	
L3 → L4 Trace Tree View	
L3 No-Trace-To-L4 View	
L3 → L4 Suspect Trace Tree View	
L4 Orginal → ReqPro Number Mapping View	
L4 ReqPro → Original Number Mapping View	
L4 → L3 Traced-from View	
L4 No-Trace-From-L3 View	
L4 → L3 Suspect Trace Tree View	
L4 → Design Trace View	
Testers Views	
Main C&DH Testers View	
Main ACS Testers View	
Processor 1Testers view	
Processor 1Testers view	

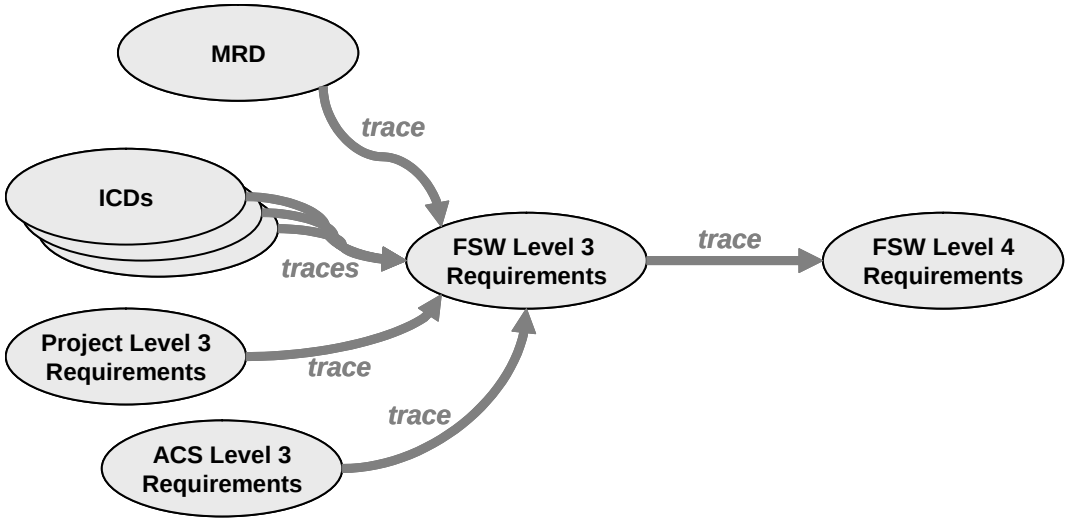
3.0 REQUIREMENTS TRACEABILITY

3.1 REQUIREMENTS TRACEABILITY MATRIX

Traceability relationships are defined among the requirement types as follows:

Describe traceability between different requirement types that is implemented in RequisitePro. If a traceability is established outside of RequisitePro, mention it as well.

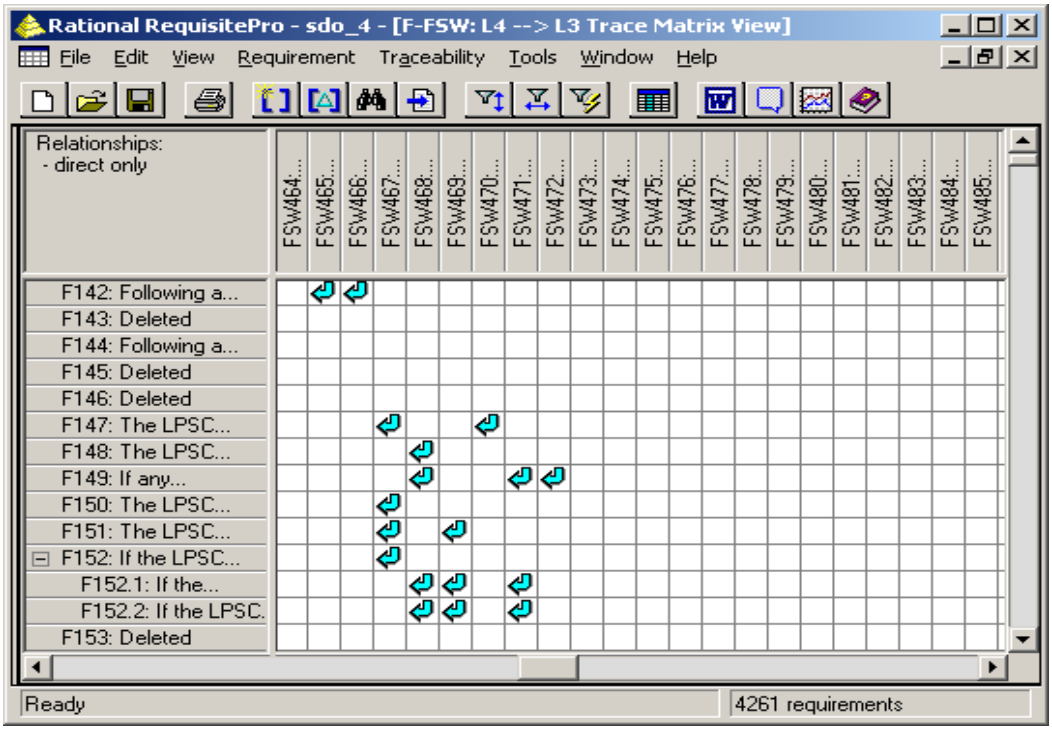
These relationships are illustrated in Figure 3-1.



Replace above figure with project specific figure.

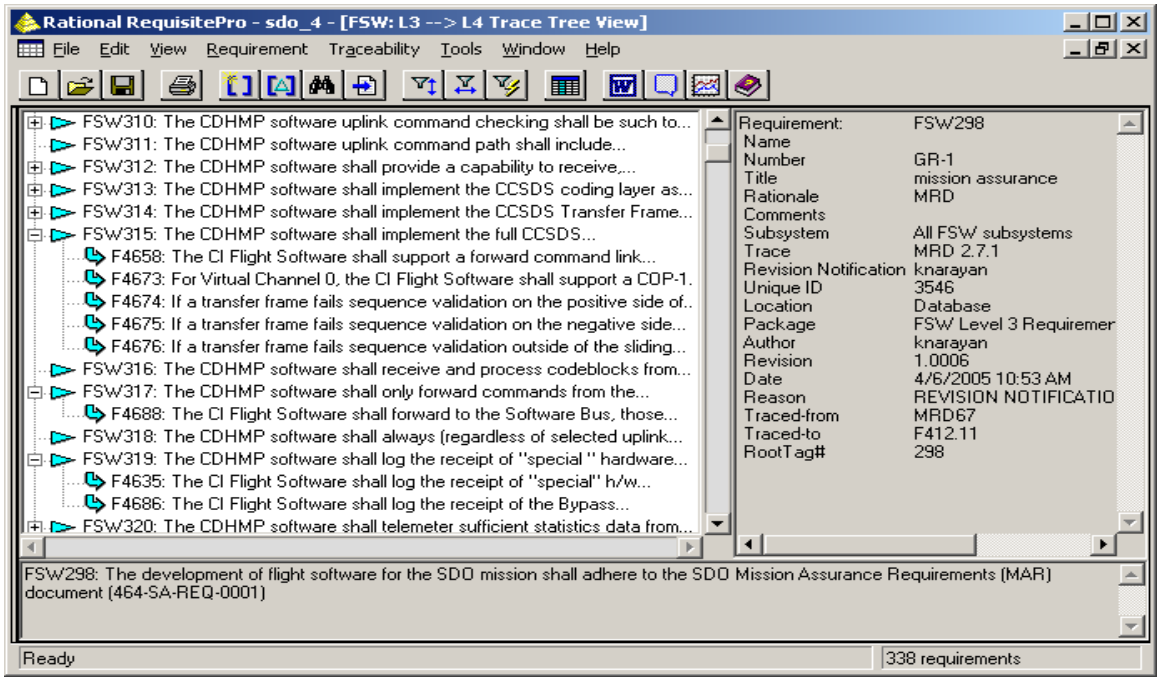
Figure 3-1. [MISSION NAME] Traceability Relationships

These relationships are viewed using various *traceability matrix* views and *traceability tree* views, or through the *traced-to/traced-from* attributes in *attribute matrix* views, as shown in the examples in Figures 3-2, 3-3, and 3-4, respectively.



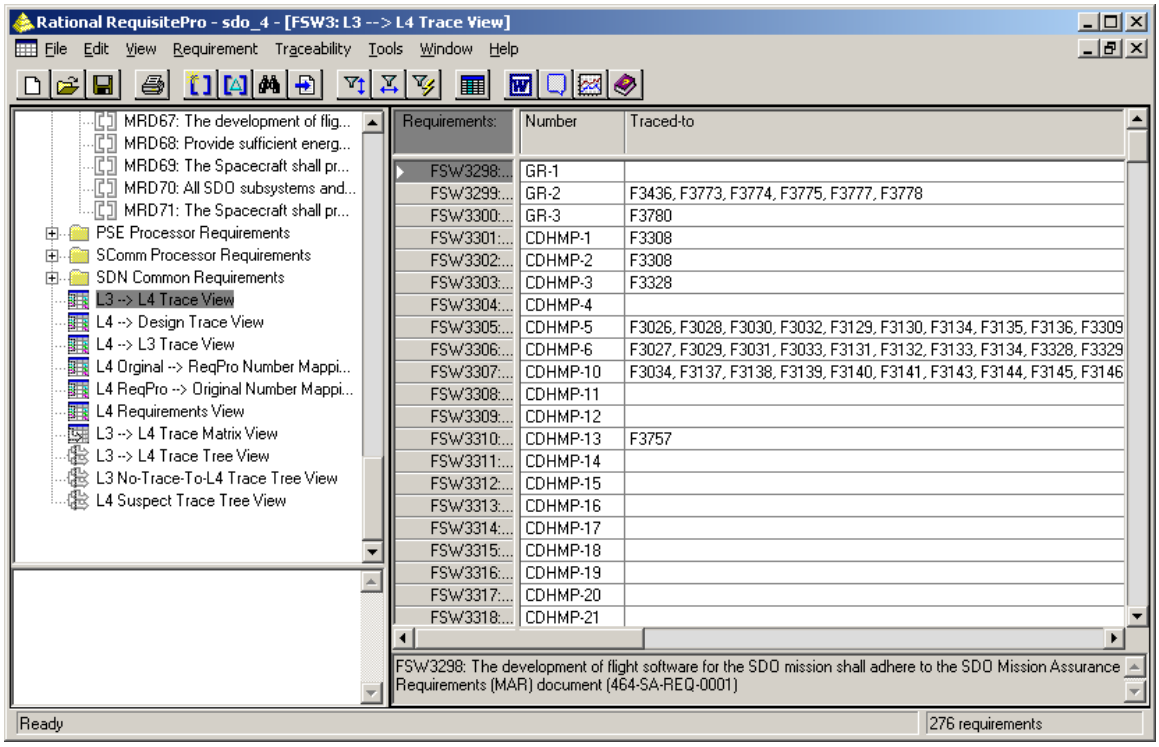
Replace above figure with project specific figure.

Figure 3-2. FSW L4 → FSW L3 Traceability Matrix View



Replace above figure with project specific figure.

Figure 3-3. FSW L3 → FSW L4 Traceability Tree View



Replace above figure with project specific figure.

Figure 3-4. FSW L3 → FSW L4 Traceability Attribute View

3.2 REQUIREMENTS-TO-DESIGN TRACEABILITY

Modify as necessary.

Traceability is established in RequisitePro between FSW Level [LEVEL] Requirements and FSW design through the design attributes: *PDR Section* and *CDR Section*.

3.3 REQUIREMENTS-TO-TEST TRACEABILITY

Traceability is established in RequisitePro between FSW Level [LEVEL] Requirements and FSW testing through several test attributes – listed under *Build Test, System Test, and Miscellaneous* in Table 2-1.

4.0 REQUIREMENTS MANAGEMENT

4.1 RESPONSIBILITIES

RequisitePro is configured with the groups and privileges as listed in Table 4-1.

Table 4-1. Groups, Privileges, and Responsibilities

Modify Table as needed

Group	Privileges and Responsibilities
Developer Lead	View/Update requirements, documents, attributes, traceability
Developers	View requirements, attributes, documents
Test Lead	View requirements, attributes, documents; Update test-related attributes
Testers	View requirements, attributes, documents; Update test-related attributes
Users	View requirements, attributes, documents

4.2 MANAGING REQUIREMENT CHANGES

Describe where the *FSW Requirement Change Management Process* is documented. Mention that all changes must be approved by the authority identified in the process (e.g., Configuration Control Board (CCB), Independent Review Board (IRB)) before implementation.

In the following 'Iteration' may be used in place of 'Build.'

It is critical that requirement changes be carefully configuration controlled and coordinated to ensure synchronization with the integration and test cycles. The requirements change management process is as follows:

1. 'Freeze' requirements for the next build test on an agreed upon date.

2. Generate and distribute a report of all changes to requirements from the previous build freeze date to the next build freeze date.

3. If at all possible, avoid making changes to any requirements after the freeze date. Information regarding necessary changes is distributed as soon as they are implemented in RequisitePro. Change the freeze date accordingly.

   Note: *Changes may be done to requirement documents 'off-line' without impacting the current versions in RequisitePro. These changes are targeted at succeeding builds.*

4. Include the correct versions of the requirements in the test reports.

5. After the build test is complete implement the approved requirement changes as described in the following sections.

4.2.1 Updating and Deleting Requirements

4.2.1.1 REQUIREMENT CHANGES IN REQUISITEPRO WORD DOCUMENTS

After a requirements change is approved by the [APPROVAL AUTHORITY], edit the online requirement by opening the appropriate *RequisitePro Word* document, or by accessing the RequisitePro database package containing the requirement.

1. Locate the requirement in the document or package.

2. Effect the necessary changes to the requirements text or other attributes. Enter the reason for the change.

3. If a requirement is to be deleted, change the requirement text and the status attribute to ***Deleted***.

4. RequisitePro will track this change, and incorporate the appropriate change information in the database and document. RequisitePro ensures that the single change is implemented in both the document and the database.

4.2.1.2 COMMON REQUIREMENT CHANGES

This section may be deleted if there are no "common" requirements. Otherwise, describe the procedure for making changes to common requirements. Modify the following as necessary.

After a requirements change is approved by the [APPROVAL AUTHORITY], the requirement must be changed individually in every location where it exists:

1. Define a new view in RequisitePro that displays ALL instances of the requirement to be changed.

2. Edit ALL instances of the requirement in the view. Enter the reason for the change.

3. Carefully review the changes to ensure that the changes are the same in each instance.

4. If a requirement is to be deleted, change the requirement text and the status attribute to ***Deleted***. Make this same change to all instances of the requirement.

5. RequisitePro will effect the changes in the corresponding *RequisitePro Word* document.

4.2.1.3 REQUIREMENTS CHANGES IN NON-WORD DOCUMENTS

For requirements that are in a non-Word document (e.g., Excel)

1. Open the requirement source file.

2. Effect the changes to the requirement in the file. Updates the attributes as necessary and update any dates and change information associated with the requirement.

3. If a requirement is to be deleted, change the requirement text and the status attribute to Deleted. If the requirement is common, 'delete' all instances of the requirement.

4. Save the new version of the file.

5. Access the RequisitePro database.

6. Open the package containing the requirement, and locate the requirement.

7. Edit the requirement, making the same changes that were made in the source file. Update the associated attributes as necessary. Enter the reason for the change.

8. If a requirement is to be deleted, change the requirement text and the *status* attribute to ***Deleted***.

9. Exit the RequisitePro database, ensuring that the changes are saved.

4.2.2 Maintaining Requirements Traceability

Requirements traceability is a configured item, and subject to [APPROVAL AUTHORITY] approval. The DCR process, documented in Reference 2, should be followed to implement any change associated the requirement traceability.

The following steps need to be followed whenever requirements are changed:

1. When a new requirement is created, map its traceability. Every FSW Level [LEVEL] requirement should be traced to a parent FSW requirement, and vice versa.

2. When a requirement is changed, or deleted, all its relationships to and from its linked requirements become suspect. For every requirement that is changed or deleted examine the traceability matrix or tree to determine its linked requirements. RequisitePro marks these suspect relationships. A traceability view has been set up to view ALL suspect relationships for FSW Level [LEVEL] requirements (see Figure 4-1).

3. Prior to every [APPROVAL AUTHORITY] meeting, produce a project summary, listing any changes to and deleted requirements. Analyze these changes, prepare and propose resolutions to any issues at the [APPROVAL AUTHORITY].

4. Determine the impact of the requirement change to each linked requirement, and take appropriate action:
   - Clear suspect relationship if no impact
   - Change linked requirements ([APPROVAL AUTHORITY] approval required) and repeat this process for the changed requirements

5. Document the impact in the Requirement Change DCR per Requirement Change approval process.

4.2.3 Updating Testing Attributes

4.2.3.1 MAKING DISCRETE CHANGES

From any test-related view (listed in Table 2-2) that shows the requirement and its test-related attributes (listed in Table 2-1) make changes to the attributes as necessary. Multiple requirements may be selected if the same change has to be made to an attribute – select, right click, and *set value*.

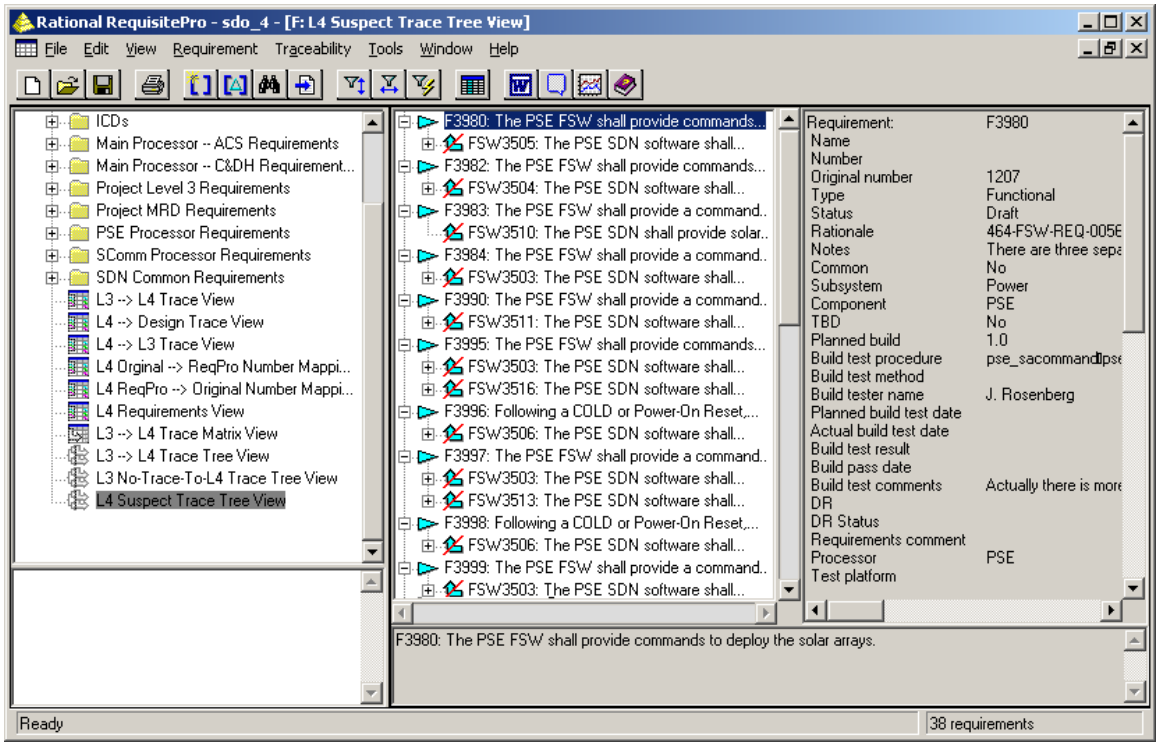
4.2.3.2 MAKING BULK CHANGES

RequisitePro has a wizard for exporting and importing Excel spreadsheets (as a CSV file). To make bulk changes:

1. Use **File > Export > Export to CSV** to export an appropriate test-related view that includes the requirements and attributes that need to be updated to a CSV file. Save the CSV file as an Excel spreadsheet.

2. Make changes in the spreadsheet. Attribute columns that are not updated may be deleted in the spreadsheet. **Do not delete the RequisitePro Requirement Tag column** (first), as the Tag is used to identify the requirement that is to be updated! Also, **do not add any new columns or rows**. Save the spreadsheet as a CSV file.

3. Use **File > Import** to import the CSV file into RequisitePro using 'update attribute only' option.



Replace above figure with project specific figure.

Figure 4-1. Suspect traceability relationships through Traceability Tree

5.0 REPORTS GENERATION

5.1 REQUIREMENT DOCUMENTS

The requirements documents produced by RequisitePro represent requirement reports that are configuration controlled.

To generate Word documents directly from RequisitePro open the *RequisitePro Word* document and use **RequisitePro > Save As**. The resulting documents are identical to the original documents – except for requirement formatting.

Requirements that are in the database but do not have any associated documents may be exported to an Excel spreadsheet, or a Word table. Use any of the defined views or set up appropriate new views and use **File > Export**. These will lack context information, however, and may be used to update existing tables in external documents.

5.2 TRACEABILITY MATRICES AND TREES

Traceability Matrices and Trees, or any other views (see Table 2-2), may be exported to a spreadsheet or a Word document. Use the *Suspect Trace* views to capture and analyze the impact of requirement changes.

Open the desired view and use **File > Export**.

5.3 SUMMARY OF REQUIREMENT CHANGES / NEW REQUIREMENTS

To get a summary of all changes or additions to requirements in a specified time period:

1. Use **RequisitePro → Tools → Metrics** to bring up the metrics user interface
2. Specify **Filter** – ***Requirement Text Change*** or ***Requirement Creation*** (see online Help for more details).
3. Select **Options/Time Period** and specify the time period.
4. Select **Options/Output Requirements Detail**.
5. Press **Create Report**. The report will be generated as an Excel spreadsheet.[JFO5]

APPENDIX A. REQUISITEPRO CLIENT CONFIGURATION

After installing RequisitePro client on the user's computer, contact the [MISSION NAME] RequisitePro administrator to perform the following configuration:

1. Enter Port 27002 under settings in the License Key Manager.

2. Add the client IP and user information to access the RequisitePro server ([SERVER NAME]) across the firewall.

3. Add the user to one of the ReqPro user groups with a userid and password.

4. Locate the shared RequisitePro Project folder and map it to a network drive (e.g., *Z*:).

5. Run RequisitePro Project by double clicking the ***.RQS*** file in the mapped network directory.

6. For Remote Desktop Connection to RequisitePro server get access for Port 3389 (needed only for those who need direct access which is very limited).